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DATE: June 2, 2009

TO: Mark Sprenger, ERT Work Assignment Manager

THROUGH: Larry Lyons, REAC Task Leader *[Signature]*

FROM: Jon McBurney, REAC Environmental Engineer *[Signature]*

SUBJECT: SIDE SCAN SONAR AND DIVER INVESTIGATION SURVEYS AT THE RARITAN BAY SLAG SITE, SITE INVESTIGATION AND ANALYTICAL RESULTS - WORK ASSIGNMENT #0-356

SITE INVESTIGATION

Under this Work Assignment (WA), technical support was provided to the United States Environmental Protection Agency (EPA)/Environmental Response Team (ERT) and EPA Region II to conduct side scan sonar and diver investigation surveys of the Raritan Bay Slag Site in Old Bridge Township, New Jersey (NJ). This assessment relates to the slag and associated debris used for constructing the sea wall and the Cheesquake Creek inlet jetty at this site (See Figure 1). The primary objectives of the investigation included:

- 1) To investigate if slag may have extended or could have been dumped along the coastal zone of this site (1.25 miles) extending from the eastern end of the sea wall to 0.25 miles west of the western jetty;
- 2) To investigate if the slag extended from the western jetty into either the Cheesquake Creek Inlet or to the western side of the jetty;
- 3) To investigate the topography of the Cheesquake Creek Inlet; and
- 4) To collect sediment samples within the Cheesquake Creek Inlet for metal determinations.

On April 27, 2009, REAC personnel conducted a Side Scan Sonar survey of the inlet to Cheesquake Creek from the Route 35 Bridge extending into the Raritan Bay. Using a Marine Sonic Side Scan Sonar equipped with a 600 Kilohertz (kHz) sonar towfish, sonar images were collected of the bottom of the channel. The EPA vessel Kenneth Biglane was employed to navigate several transects into and out of the inlet. The sonar towfish was deployed from the bow of the Biglane and was adjusted to a depth of approximately three to five feet below the surface of the water. Water depths in the inlet ranged from 5 to 20 feet depending on location and tidal stage.

On April 28, 2009 the survey was continued in the area adjacent to the inlet, approximately 0.25 miles to the northwest and approximately one mile to the southeast, extending approximately 0.25 miles into Raritan Bay. Transects were set up parallel to the shoreline approximately 30 meters apart.

On April 29 and 30, 2009, EPA-certified divers conducted diving operations in and around the inlet to verify conclusions based on the side scan sonar data and to collect sediment samples from the inlet. Divers conducted seven dives totaling three hours of bottom time.

RESULTS

The side scan imagery was post processed and a mosaic was created to cover the inlet and the neighboring jetties (See Figure 1). The sediment sample locations were plotted based on global positioning system (GPS) coordinates and added to the sonar mosaic.

The results of the side scan survey and diver investigations are as follows:

1. The side scan survey covered approximately two miles of coastline extending from the cove area just east of the seawall to approximately 0.5 miles west of the Cheesequake Creek Inlet western jetty. Approximately nine transects were completed along the shoreline to a distance of approximately 1,800 feet into Raritan Bay. The coverage area is detailed in Figure 2. This entire search showed no indication on the sonar record of any items larger than single rocks, fish traps, or discarded tires. No significant rock piles were noted during the side scan survey. To verify the sonar image as well as the GPS data generated by the sonar image, a sunken barge was chosen as a dive location (Figure 3). A GPS point located in the center of the bow was chosen from the sonar image, a buoy was placed at that location, and a diver was deployed to verify the sonar image and location. The diver confirmed the placement of the buoy and the sonar image.
2. The main channel of the Cheesequake Creek Inlet is of a uniform material with long axial grooves. Diver reconnaissance agreed with the sonar picture and further clarified that the material was rounded gravel approximately 1 to 2 inches in size. The grooves were "v" shaped, approximately one foot in width and ran axially along the inlet. Minimal sediment was found in these areas. The main channel composition was homogenous up to the Western Jetty.
3. To the southeast of the gravel channel, a darker area with uneven texture can be seen on the sonar mosaic. This area contains a sandy material, and the uneven structures seen on the sonar mosaic are sand waves created by the changing currents in the inlet. Divers were unable to positively verify this composition; however, during a transect that began at S-6 and finished at S-7, a changeover was noted from the gravel bottom to a much more sandy bottom, indicating that the southwestern area is most likely sand covered. The aerial photograph shown on Figure 1 seems to indicate that the beach located to the southeast has been depositing sand onto and over the Eastern Jetty.
4. Sonar records indicated a large boulder in the location noted T-2. This location was verified by the diver as a large boulder located at the toe of the rock jetty.
5. Divers observed that the boulders at the toe of the slope were large, angular quarry stone covered in algae and many orange sponges. Slag was not observed by the divers along the toe of the Western jetty on the inlet side.
6. The diver investigating an area outside of the inlet encountered several pairs of horseshoe crabs that were believed to be mating. The diver investigating the inlet also encountered at least one horseshoe crab during his investigation.
7. Samples were collected from the Cheesequake Creek Inlet as noted on Figure 1. The composition of each sample is as follows:
 - S-1. No sediment, sample consisted 100% of pebbles and stones. (Figure 4)
 - S-3. No sediment, sample consisted 100% of pebbles and stones. (Figure 5)
 - S-4. No sediment, sample consisted 100% of pebbles and stones. (Figure 6)
 - S-6. No sediment, sample consisted 100% of pebbles and stones. (Figure 7)
 - S-7. No sediment, sample consisted 95% of pebbles and stones, 5% coarse sand. (Figure 8)
 - S-9. Sample consisted of 85% pebbles, stones and coarse sand, 15% sediment (Figure 9). One 4-ounce jar was submitted for metals analysis.

S-10. No sediment, sample consisted 100% of pebbles and stones. (Figure 10)

S-13. Sample consisted of 85% pebbles, stones and coarse sand, 15% sediment (Figure 11). One 4-ounce jar was submitted for metals analysis.

S-14. Sample consisted of 90% pebbles, stones and coarse sand, 10% sediment (Figure 12). One 4-ounce jar was submitted for metals analysis.

S-15. No sediment, sample consisted 100% of pebbles and stones. (Figure 13)

S-16. Sample consisted of 90% pebbles, stones and coarse sand, 10% sediment (Figure 14). One 4-ounce jar was submitted for metals analysis.

ANALYTICAL RESULTS

Four of the 11 samples (S-9, S-13, S-14 and S-16) contained sediment that was analyzed for target analyte list (TAL) metals plus tin (Sn). Table 1 summarizes the analytical results. Appendix A provides the Final Analytical Report. Sample S-9 collected at the toe of the Western Jetty (See Figure 1) had particularly high concentrations of antimony (Sb), arsenic (As), copper (Cu), iron (Fe), lead (Pb) and zinc (Zn).

RECOMMENDATIONS

Two areas have not been fully investigated: the area to the west of the western jetty, and the inlet side of the eastern jetty. Based on the results of the side scan sonar survey and the dive operations, the inlet side of the eastern jetty should contain much more sedimentary material than the western jetty. This material was not adequately sampled during this investigation. Also, the area to the outside of the western jetty was not sampled during this investigation.

The side scan sonar data from the bay portion of the survey indicates that there is an area showing similar surface features to the inlet side of the eastern jetty just as the inlet empties into Raritan Bay. This area may be a depositional area from the Cheesequake Creek which was not sampled.

**Table 1: Summary of COPCs in Sediment Samples Collected from Cheesquake Creek Inlet
Collected April 29 and 30, 2009
Raritan Bay Slag Site
Middlesex County, NJ**

COPCs	Sediment Samples (mg/kg d.w.)			
	S-9	S-13	S-14	S-16
Antimony	189	24.1	5.6	U (1.2)
Arsenic	118	10	4.6	3.8
Copper	415	37.9	36.6	3.3
Lead	6,950	813	133	13.9
Manganese	69.3	66.8	101	50.2
Silver	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Tin	320	26.4	10.8	5.6
Zinc	228	78.6	61.6	16.2

COPCs = Contaminants of Potential Concern
mg/kg d.w. = milligram per kilogram dry weight
U = Undetected (Analytical Reporting Limit)

Figures



Map created using New Jersey 2007 color orthophotography from NGIN.

Map Creation Date: 6 May 2009

Coordinate system: New Jersey State Plane

FIPS: 2900.

Datum: NAD83.

Units: Feet.

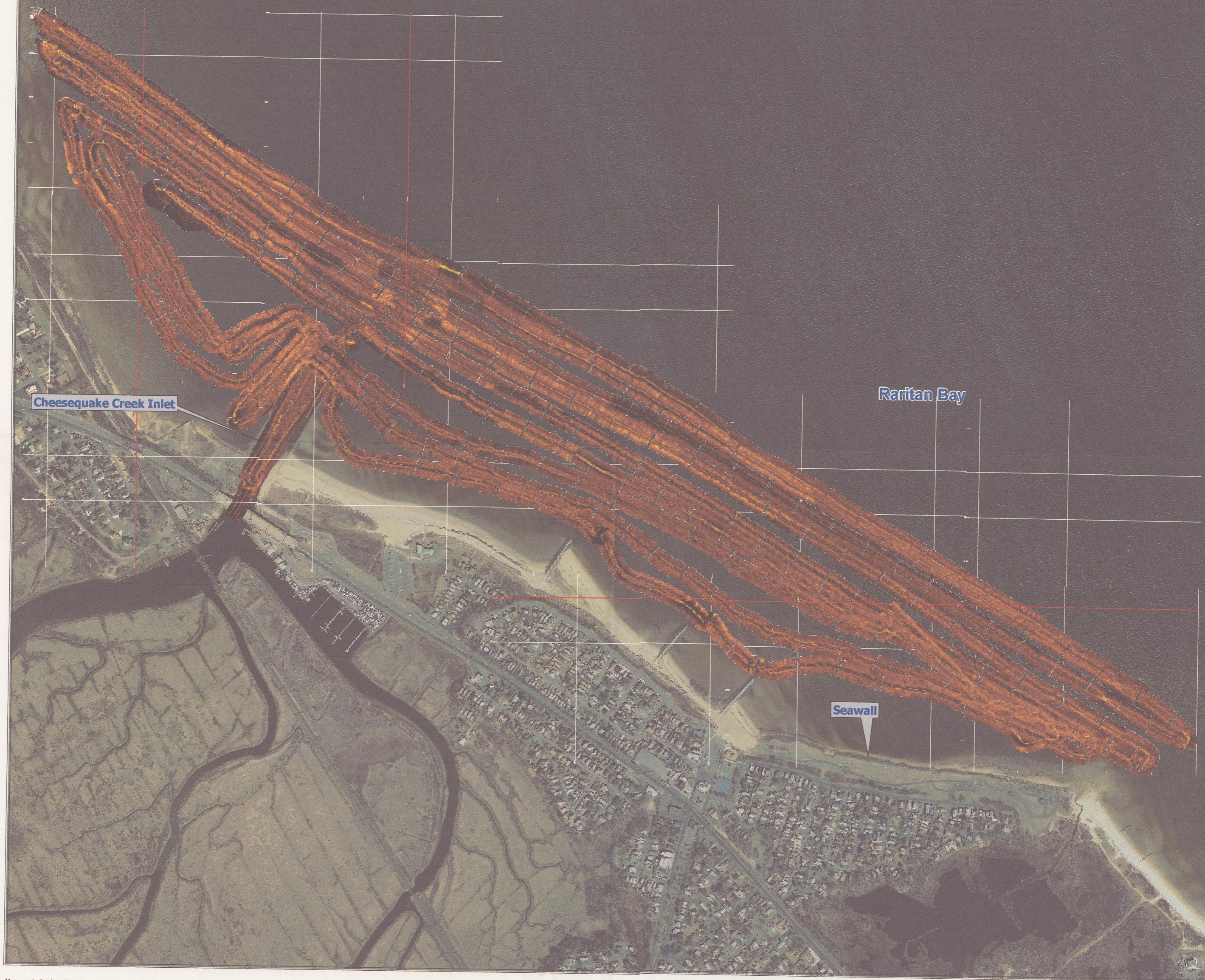
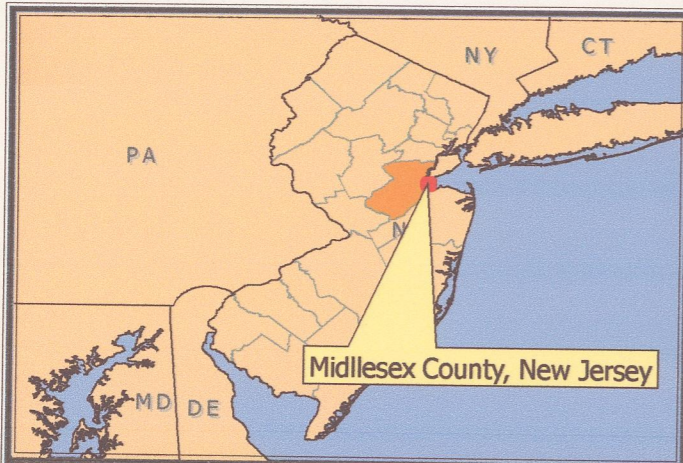
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Legend
● Sample Location

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U.S. EPA Environmental Response Team
Response Engineering and Analytical Contract
EP-C-04-032
W.A.# 0-356

Figure 1
Side Scan Imagery Cheesquake Creek Inlet
Raritan Bay Slag Site
Old Bridge Township, New Jersey
May, 2009



Map created using New Jersey 2007 color orthophotography from NGIN.

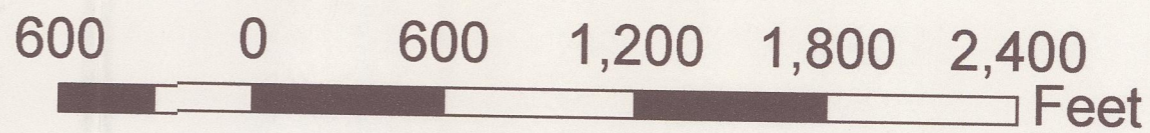
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FIPS: 2900

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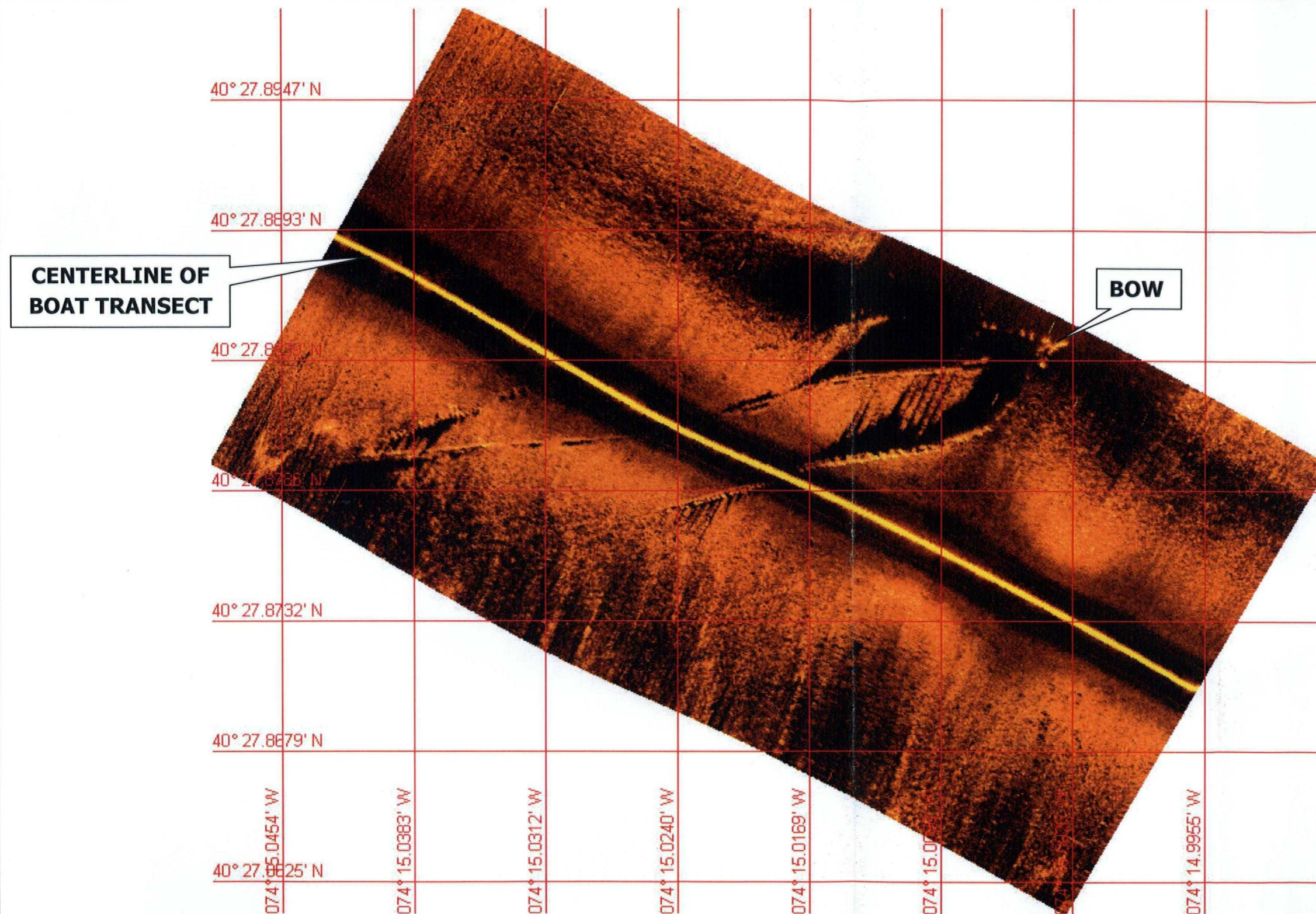
Units: Feet



Data: g:\arcviewprojects\react\00-356
MXD file: g:\arcviewprojects\react\00-356_Laurel Harbor\356_Side_Scan_Imagery2_Cheesequake_Inlet\2rev001.mxd

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Figure 2
Side Scan Imagery Raritan Bay
Raritan Bay Slag Site
Old Bridge Township, New Jersey
May, 2009



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FIGURE 3
SIDE SCAN IMAGE OF SUNKEN BARGE
RARITAN BAY SLAG SITE
OLD BRIDGE TOWNSHIP, NEW JERSEY
MAY 2009



Figure 4: Sample S-1



Figure 5: Sample S-3



Figure 6: Sample S-4



Figure 7: Sample S-6



Figure 8: Sample S-7



Figure 9: Sample S-9



Figure 10: Sample S-10



Figure 11: Sample S-13



Figure 12: Sample S-14



Figure 13: Sample S-15



Figure 14: Sample S-16

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